

U.S. Application No. 09/629,696 – Filed: August 1, 2000

Amendment Dated: May 12, 2004

Reply to Office Action Dated: February 25, 2004

REMARKS/ARGUMENTS

In the Office Action dated February 25, 2004, the Examiner has objected to the drawings as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: “425” of FIG. 19 and “21-5(a)” of FIG. 22. The Specification has been amended to include reference to “425” of FIG. 19 and “21-(5a)” of FIG. 22 to comply with 37 CFR 1.84(p)(5). Accordingly, no change is required in the original drawing of FIGs. 19 or 22. Further, the Examiner has rejected Claims 1 and 3-9 under 35 U.S.C. §102(b) as being anticipated by Lin, et al. (U.S. Patent No. 5,742,703); rejected claim 10 under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Mongeon (U.S. Patent No. 5,710,824); rejected claim 11 under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Mongeon (U.S. Patent No. 5,710,824) and Tai (U.S. Patent No. 6,694,224; rejected Claim 12 under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Yoshiake (U.S. Patent No. 5,574,833); rejected Claim 2, 13-15, 17-19, and 21-24 under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Tai (U.S. Patent No. 5,694,224); rejected Claim 16 under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Tai (U.S. Patent No. 5,694,224) and Mongeon (U.S. Patent No. 5,710,824); and rejected Claim 20 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Tai (U.S. Patent No. 5,694,224) and in further view of *In re Dulberg* (289 F.2d 522, 533, 129 USPQ 348, 349 (CCPA 1961)). By this paper, the specification and Claims 7, 8, 10, 11, and 19 have been amended to more particularly point out and distinctly claim that which Applicants regard as the invention. For the reasons set forth below, Applicants consider that Claims 1-24, as amended, now patentably distinguish over the prior art.

Claims 1 and 3-9 stand rejected under 35 U.S.C. §102(b) as being anticipated by Lin, et al. (U.S. Patent No. 5,742,703). With regard to Claim 1, the Examiner cited Lin, et al. patent disclosed how to process gray level image (input continuous tone image) with pattern matching method for image enhancement after binarization (channel A). A parallel path (channel B) processed the input continuous tone image via half-toning (see FIG. 2 of Lin, et al. for detail). Buffered data from one of the parallel channels are selected for output (to deliver high-addressability

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binary printing data with enhanced edges) based on test criterion described in Lin, et al. patent. (See column 3, lines 1-3; column 3, lines 1-20; column 7, lines 14-18; column 7, lines 24-27; column 7, lines 2-9; column 7, lines 16-18; column 7, lines 24-27; column 8, lines 40-46; column 8, lines 21-23; column 7, lines 47-55; column 8, lines 1-6; column 8, lines 10-14; column 8, lines 40-46 of Lin, et al.). However, Lin, et al., does not show, or in any way teach, image enhancement on halftone screened (either gray level or binary) images or parallel channel (both channels) processing of the halftone processed screen image data, as specifically recited in independent Claim 1. This is an important aspect of Applicants' invention in that the gray level image data has been subjected to halftone screen processing before the halftoned (HT) image data enter into the parallel path selection process (see FIG. 1 of the Application for detail), so the image enhancement is performed on the thresholded halftoned image data. This is neither shown nor in any way taught by the prior art. Therefore, it is respectfully submitted that this rejection is no longer proper. Accordingly, independent Claim 1 should now be allowed.

With regard to dependent Claim 3, the Examiner cited Lin, et al. as disclosing binarization of the input continuous-tone image via a threshold value (column 7, lines 20-27; also on contone channel A, and not on channel B, of FIG. 2 of Lin, et al.). Lin, et al. does not show, or in any way teach, thresholding of halftone processed screen (either gray level or binary) image data, as specifically recited in dependent Claim 3. The halftone gray level pixels have screen structure embedded in the image data, very different than a continuous-tone image. Regarding dependent Claim 4, the Examiner cited Lin, et al. as disclosing that the threshold value is a variable that is determined for use in the binarizing block (72 of FIG. 2 of Lin, et al.). It is preferred that the threshold value is set to about 95% of the maximum value (column 7, lines 24-26 of Lin, et al.). However, this is done for the purpose of making sure that the continuous-tone portions of the image are not inadvertently mistaken for text or line art (column 7, lines 26-27 of Lin, et al.). However, Lin, et al. does not show, or in any way teach, adjustable (note: "variable" is not synonymous with "adjustable") thresholding of halftone processed screen (either gray level or binary) image data, as specifically recited in dependent Claim 4.

With regard to dependent Claim 5, the Examiner cited Lin, et al. as disclosing an at least 600x600 spi output (column 10, lines 36-45 of Lin, et al.), which

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is the output addressability of the printing system, not the halftone frequency of the output. Lin, et al. does not show, or in any way teach, blended halftone screen processors wherein one of the screen processor has a screen frequency of at least 200 lines per inch, as specifically recited in dependent Claim 5. With regard to dependent Claim 6, the Examiner cited Lin, et al. as disclosing a current pixel (continuous toned input pixel) meeting the criterion of being a saturated color text image (via a threshold value) so as to assure that the continuous tone portions of the image are not inadvertently mistaken for line art and text, then going through a binary pattern matching process (FIGs. 4a-d). However, Lin, et al. does not show, or in any way teach, using a halftone screen processed pixel (either gray level halftone or binary) being compared with a threshold, and if meeting the criterion of being a saturated color text image, then having its gray level value adjusted to a maximum value before processed by gray level enhanced processing, as specifically recited in dependent Claim 6.

With regard to dependent Claim 7, the Examiner cited Lin, et al. as disclosing an enhancement processing (column 8, lines 1-6 of Lin, et al.) that uses high addressability (in position) binary output signal as enhancement to reduce edge jaggedness. However, Lin, et al. does not show, or in any way teach, gray level enhancement that uses modified gray level pixels (as shown in FIG. 14 and 15) of a density less than maximum density to provide smooth edge transitions, as specifically recited in amended dependent Claim 7. With regard to dependent Claim 8, the Examiner cited Lin, et al. as disclosing enhancement processing (column 8, lines 1-6 of Lin, et al.) that uses high addressability (in position) binary output signal as enhancement to reduce edge jaggedness. However, Lin, et al. does not show, or in any way teach, gray level enhancement that uses modified gray level pixels (as shown in FIGs. 14 and 15 of the Application) of a density less than maximum density to provide smooth edge transitions, or gray level enhancement processing of halftone processed image data as specifically recited in amended dependent Claim 8.

Regarding dependent Claim 9, the Examiner cited Lin, et al. as disclosing that a set of color space coordinates could be used for the image data (column 6, lines 12-21 of Lin, et al.). Since the invention disclosed by Lin, et al. works in terms of single colors (column 6, lines 17-21 of Lin, et al.), each color is processed separately, so the invention can be applied to color separation files. However, it does not show, or in

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any way teach, gray level enhancement that uses modified gray level pixels (as shown in FIGs. 14 and 15) of a density less than maximum density to provide smooth edge transitions, or gray level enhancement processing of halftone processed image data of a color separation file, as specifically recited in dependent Claim 9.

Therefore, it is respectfully submitted that this rejection is no longer proper. Accordingly, dependent Claims 3, 4, 5, 6, 9 and amended dependent Claims 7 and 8 should now be allowed.

Dependent Claim 10 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Mongeon (U.S. Patent No. 5,710,824). The Examiner has cited Lin, et al. as disclosing the use of multiple colors in printing, but does not disclose expressly that the image data is adjusted for color saturation according to personal preference. Mongeon has been cited as teaching using GCR strategy with different black colorant to enlarge the printing gamut. This disclosure is well known in the Graphic-art printing field; i.e., CMYK colorant has a larger printing gamut than CMY colorant. Also, Mongeon does not show adjustment of color saturation of color separation file according to a personal preference (such as last minute changes by customers on an already rasterized image) as disclosed in the present Application (see FIG. 18 of the Application). Further more, Lin, et al. is related to continuous-tone processing; while the current Application deals with halftoned processing after, as discussed in the above argument relating to Claim 1. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, amended dependent Claim 10 should now be allowed.

Dependent Claim 11 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703), in view of Mongeon (U.S. Patent No. 5,710,824) and Tai (U.S. Patent No. 6,694,224). The Examiner contends that Lin, et al. in view of Mongeon discloses that the image data is adjusted for color saturation according to color preferences, but does not disclose that the image data is analyzed for contrast. Tai has been cited as disclosing image data is analyzed for contrast. In the disclosure of Tai, the image data are processed and blended according to blending index. However the image data is not adjusted for color separation and not processed further to enhance the edge pixels. Lin, et al. does not show processing

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of image enhancement on halftoned images and both Mongeon and Tai do not show image enhancement at all. There are significant differences between image enhancements on halftone images versus on binarized continuous tone images. In addition, further processing of halftone image data of Tai with the binary halftone process (Channel B) of Mongeon will cause significant Moiré artifacts. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, amended dependent Claim 11 should now be allowed.

Dependent Claim 12 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Yoshiake (U.S. Patent No. 5,574,833). The Examiner has cited Lin, et al. as disclosing smoothing edges using higher output addressability data (FIGs. 4a-d and FIG. 6); but Lin, et al. does not disclose expressly that the resolution enhancement processor is adjustable to provide for different levels of smoothing of edges. Yoshiaki has been cited as showing digital enlarged original processed binary image with smoother edges. Yoshiake requires the output has higher addressability than the input. Both Yoshiake and Lin, et al. do not teach a resolution enhancement processor that is adjustable to provide for different levels of smoothing of edges while the output addressability of the system stays the same. Also both Yoshiake and Lin, et al. do not teach enhancement with halftoned input images. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 12 should now be allowed.

Dependent Claims 2, 13-15, 17-19, and 24-26 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Tai (U.S. Patent No. 5,694,224). With regard to dependent Claim 2, the Examiner has cited Lin, et al. as disclosing processing gray level image data through a halftone screen, but does not disclose expressly that the gray level image data is processed independently through plural halftone screen processor and the output of the two processors are blended. Tai discloses the gray level image data is processed independently through plural halftone screen processors and the outputs of the processors are blended. Both Lin, et al. and Tai do not teach using the blended halftone processed screen image for image enhanced processing. Accordingly,

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Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 2 should now be allowed. Regarding independent Claim 13, the Examiner cited Lin, et al. as disclosing how to process gray level image (input continuous tone image) with pattern matching for image enhancement after binarization (channel A of Lin, et al.). A parallel path (channel B of Lin, et al.) processes the input continuous tone image via halftoning (see FIG. 2 of Lin, et al. for detail). Buffered data from one of the parallel channels is selected for output (to deliver high-addressability binary printing data with enhanced edges) based on test criterion described in Lin, et al. Lin, et al. does not disclose expressly subjecting first gray level image data to plural separate halftone screen processing to form plural separate halftone screen processed gray level image data. Tai discloses subjecting first gray level image data to plural separate halftone screen processing to form plural separate halftone screen processed gray level image data and its blending processes. However, combining the blended halftone processed image input disclosed by Tai to the process of Lin, et al. (as grayscale input in FIG. 2) will cause moiré problems in the channel B halftone process of Lin, et al. Even if the halftone process in channel B of Lin, et al. is replaced by the blended halftone image of Tai as suggested by the Examiner, such combination does not address image enhancement on the halftoned image as recited in Claim 13. The image enhancement function of Lin, et al. is only performed on the binarized non-halftoned image data in channel A. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, independent Claim 13 should now be allowed.

With regard to dependent Claim 14, Examiner has cited Lin, et al. as disclosing processing gray level image data through a halftone screen. However, Lin, et al. does not disclose expressly that, in the step of determining if the gray level of the blended halftone screen processed current pixel meets the threshold criterion, there are also examined gray levels of blended halftone screen processed neighboring pixels to the current pixel. Tai discloses that gray levels of blended halftone screen processed neighboring pixels to the current pixels are also examined in the step of determining if the gray level of the blended halftone screen processed current pixel meets the threshold criterion. Both Lin, et al. and Tai do not teach image

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enhancement of halftoned image. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 14 should now be allowed. Regarding dependent Claim 15 the Examiner sets forth the reasons for unpatentability similar to those asserted against Claim 4 (Claim 14?). However, as noted above, the references do not show, or in any way teach, adjustable thresholding of halftone processed screen (either gray level or binary) image data. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 15 should now be allowed.

Regarding dependent Claim 17, the Examiner cited Lin, et al. as disclosing that the current pixel meeting the threshold criterion has its gray level value adjusted to a maximum value before being processed by gray level enhanced processing. The thresholding process is done on the binarized continuous tone input image on channel A of Lin, et al. (FIG. 2). However, the Lin, et al. does not show, or in any way teach, using a halftone screen processed pixel (either gray level halftone or binary) being compared with a threshold, and if meeting the criterion of being a saturated color text image, then having its gray level value adjusted to a maximum value before processed by gray level enhanced processing. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 17 should now be allowed. With regard to dependent Claim 18, the Examiner sets forth the reasons for unpatentability similar to those asserted against Claim 5. However, as discussed above, the references do not show, or in any way teach, blended halftone screen processors wherein one of the screen processor has a screen frequency of at least 200 lines per inch as specifically recited. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 18 should now be allowed. Regarding dependent Claim 19, the Examiner sets forth the reasons for unpatentability similar to those asserted against Claim 8. However, as discussed above, the references do not show, or in any way teach, gray level enhancement using modified gray level pixels (as shown in FIG. 14 and 15) of a density less than maximum density to provide smooth edge transitions, or

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gray level enhancement processing of halftone processed image data as specifically recited in amended dependent Claim 19. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, amended dependent Claim 19 should now be allowed.

With regard to independent Claim 21, the Examiner has cited Lin, et al. as disclosing how to process gray level image (input continuous tone image) with pattern matching for image enhancement after binarization (channel A). A parallel path (channel B) processes the input continuous tone image via half toning (see FIG. 2 of Lin, et al. for detail). Buffered data from one of the parallel channels are selected for output (to deliver high-addressability binary printing data with enhanced edges) based on test criterion described in Lin, et al.. Lin, et al. further discloses that, if the continuous-tone gray-scale data (block 70 of FIG. 2) current pixel is substantially a maximum density pixel or is adjusted to be a substantially maximum density pixel, then such pixel is subjected to a pattern matching operation (channel A). However, this is done for the purpose of making sure that the continuous-tone portions of the image are not inadvertently mistaken for text or line art (column 7, lines 26-27 of Lin, et al.). Lin, et al. does not disclose expressly subjecting first gray level image data to plural separate halftone screen processing (for example in channel B halftoning operation), to form plural separate halftone screen processed gray level image data. Tai discloses subjecting first gray level image data to plural separate halftone screen processing to form plural separate halftone screen processed gray level image data and blending operation. If the teaching of Tai is used with Lin, et al., it will be on channel B where halftoning is done. Channel A of Lin, et al. only does enhancement on binarized continuous tone input image (see FIG. 2). Both Lin, et al. and Tai have not taught image enhancement of halftoned image. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, independent Claim 21 should now be allowed. With regard to dependent Claim 22, the Examiner has cited the Lin, et al. patent as disclosing how to process gray level image (input continuous tone image) with pattern matching for image enhancement after binarization (channel A). A parallel path (channel B) processes the input continuous tone image via half toning (see FIG. 2 of Lin, et al. for detail). Lin, et al. does not

disclose expressly that such halftone screen processing employing a partial dot growth pattern and another screen that employing a mixed dot growth. Also, only one of the channels in Lin, et al. is halftoned. Tai discloses a halftone screen processing employing a partial dot growth pattern and a mix dot growth pattern; however, no image enhancement of the blended halftone is taught therein. Both Tai and Lin, et al. do not teach the specifically recited (in Claim 22) enhancement of blended halftone image wherein the plural separate halftone screen processing include a halftone screen processing employing a partial dot growth pattern and a halftone screen processing employing a mix dot growth pattern. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 22 should now be allowed.

Regarding dependent Claim 23, the Examiner has cited Lin, et al. as disclosing how to process gray level image (input continuous tone image) with pattern matching for image enhancement after binarization (channel A). A parallel path (channel B) processes the input continuous tone image via half toning (see FIG. 2 of Lin, et al. for detail). Lin, et al. does not disclose expressly halftone screen processing employing a halftone screen processing suitable for a text type image and a halftone screen processing suitable for a pictorial image. Also, only one of the channels in Lin, et al. is halftoned. Tai discloses that the plural separate halftone screen processing comprise a halftone screen processing suitable for a text type image and a halftone screen processing suitable for a pictorial image; however, no image enhancement of the blended halftone has been taught therein. Both Tai and Lin, et al. do not teach the cited enhancement of blended halftone image wherein the plural separate halftone screen processing comprise a halftone screen processing suitable for a text type image and a halftone screen processing suitable for a pictorial image as specifically recited in Claim 23. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 23 should now be allowed. With regard to dependent Claim 24, the Examiner has cited Lin, et al. as disclosing how to process gray level image (input continuous tone image) with pattern matching method for image enhancement after binarization (channel A). A parallel path (channel B) processed the input continuous tone image via half toning

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(see FIG. 2 of Lin, et al. for detail). Lin, et al. does not disclose expressly that the halftone screen processed gray level image data is blended according to blending coefficients. Also, only one of the channels in Lin, et al. is halftoned. Tai discloses a halftone screen processed gray level image data is blended according to blending coefficients, but no image enhancement of the blended halftone is taught therein. Both Tai and Lin, et al. do not teach enhancement of blended halftone image wherein the plural separate halftone screen processed gray level image data is blended according to blending coefficients as specifically recited in Claim 24. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 24 should now be allowed.

Dependent Claim 16 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Tai (U.S. Patent No. 5,694,224) and Mongeon (U.S. Patent No. 5,710,824). As discussed above, Lin, et al. discloses how to process gray level image (input continuous tone image) with pattern matching image enhancement after binarization (channel A). A parallel path (channel B) processes the input continuous tone image via half toning (see FIG. 2 of Lin, et al. for detail). Lin, et al. does not disclose expressly that the first gray level image data is color separation image data and that, prior to subjecting the first gray level image data to halftone processing, the gray level image data is subjected to processing for gray component replacement or undercolor removal. Tai discloses that the first gray level image data is color separation image data. Tai further subjects the first gray level image data to plural separate halftone screen processing. Both Lin, et al. and Tai do not disclose expressly that the gray level image data is subject to processing for gray component replacement and undercolor removal. Mongeon discloses subjecting color separation image data to processing for gray balance and undercolor removal. Neither Tai, Lin, et al. nor Mongeon teach the recited enhancement of blended halftone image wherein the first gray level image data is color separation image data and prior to subjecting the first gray level image data to plural separate halftone screen processing the gray level image data is subject to processing for gray component replacement or undercolor removal as specifically recited in Claim 16. Accordingly, Applicants' invention would not be obvious to one

of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, dependent Claim 16 should now be allowed.

Independent claim 20 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Lin, et al. (U.S. Patent No. 5,742,703) in view of Tai (U.S. Patent No. 5,694,224), and in further view of *In re Dulberg* (289 F.2d 522, 533, 129 USPQ 348, 349 (CCPA 1961)). Lin, et al. discloses an apparatus to process gray level image (input continuous tone image) with pattern matching method for image enhancement after binarization (channel A). A parallel path (channel B) processed the input continuous tone image via half toning (see FIG. 2 of Lin, et al. for detail). Lin, et al. does not disclose expressly that the two image data processing devices are first and second halftone screen processing devices. Furthermore, Lin, et al. does not disclose expressly a device for analyzing the current pixel for contrast index, and device responsive to the contrast index for generating blending coefficients; a blending operation processor that generates a blended halftone data for the current pixel and a gray level image enhancement processing device connected to the output of the blending operation processor. Tai discloses first and second halftone screens that form plural separate halftone processed screen gray level image data. Tai also discloses a device for analyzing a current pixel for contrast index and this is responsive to the contrast index for generating blending coefficients. Tai further discloses a blending operation processor, that generates a blended halftone data for the current pixel. Tai still further discloses a gray scale image mapper and tone adjustment device (340 of FIG. 18 of Tai) so that the image can be tone adjusted. Tai does not teach using anti-aliasing edge enhancement (such as GRET in FIG. 1 and 12 of this Application) with halftone processed image that is specifically recited in Claim 20. Gray scale mapping and tone adjustment operation on a halftone image is very different than anti-aliasing image enhancement on a halftone image. Gray scale mapping and tone adjustment operation is a global adjustment that is not sensitive towards the halftone structure of the image. On the other hand, anti-aliasing edge enhancement is image structure dependent. Both Tai and Lin, et al. do not teach the cited apparatus of image enhancement on blended halftone image as specifically recited in Claim 20. The Examiner contends that, in view of *In re Dulberg*, it would be obvious to split the blending screen logic control device of Tai into two separate devices since there is no unexpected result. However, as explained immediately

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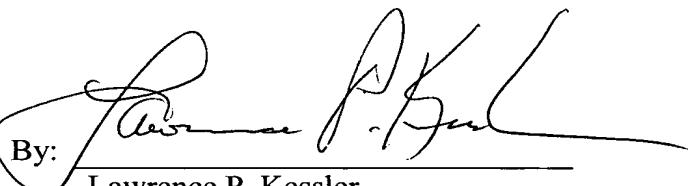
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above, the two functions are different (i.e., one is image structure dependent and one is not image structure dependent), and can therefore not be provided by simply splitting the one device of the reference. Accordingly, Applicants' invention would not be obvious to one of ordinary skill in the art in view of the cited references either individually or in any proper combination. Therefore, independent Claim 20 should now be allowed.

Applicants are not aware of any additional patents, publications, or other information not previously submitted to the Patent and Trademark Office which would be required under 37 C.F.R. §1.99.

This Application is now believed to be in condition for favorable reconsideration and early allowance, and such actions are respectfully requested.

Respectfully submitted,

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